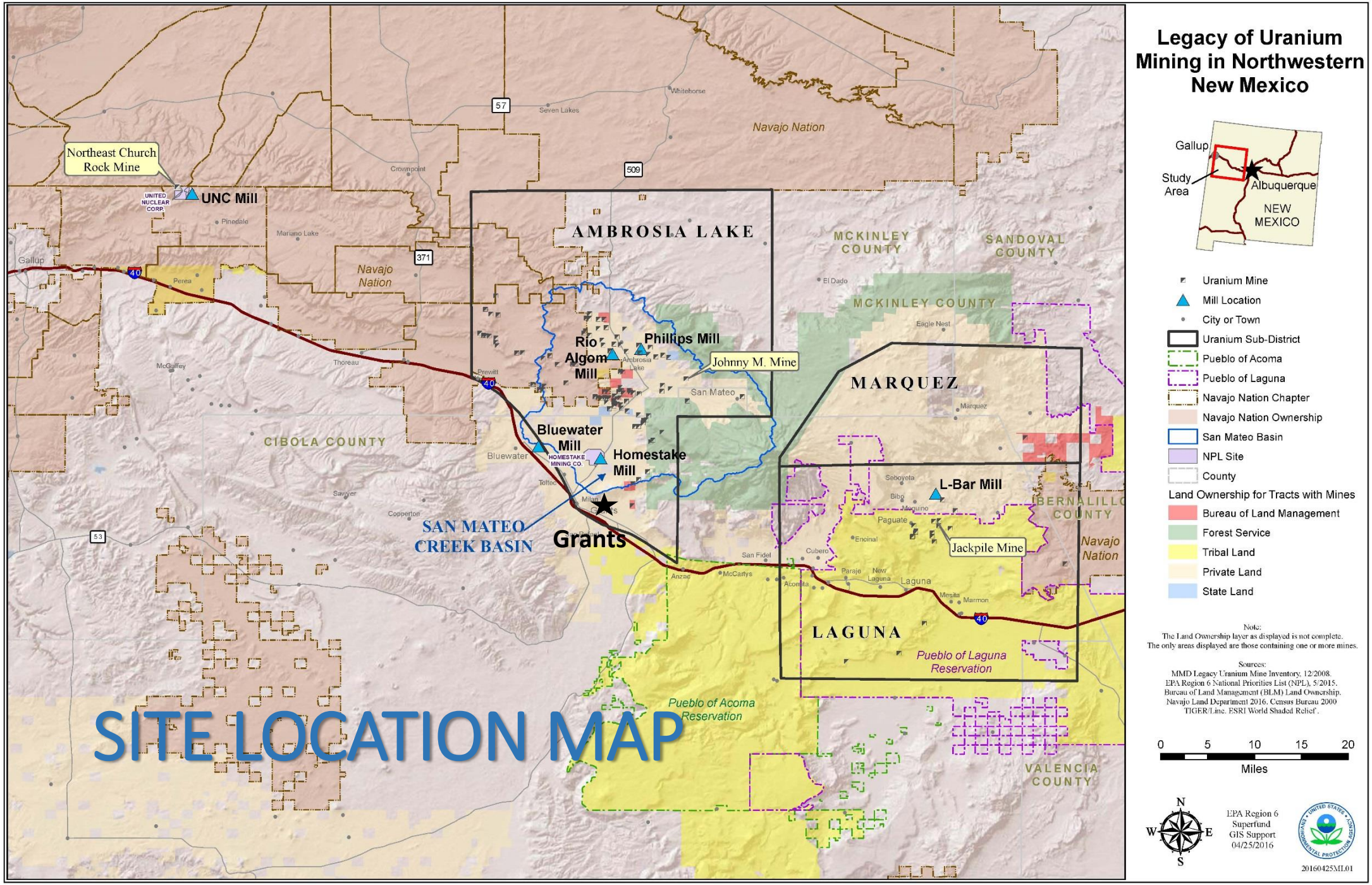
EPA GROUND WATER INVESTIGATION

San Mateo Creek Basin Uranium Legacy Site

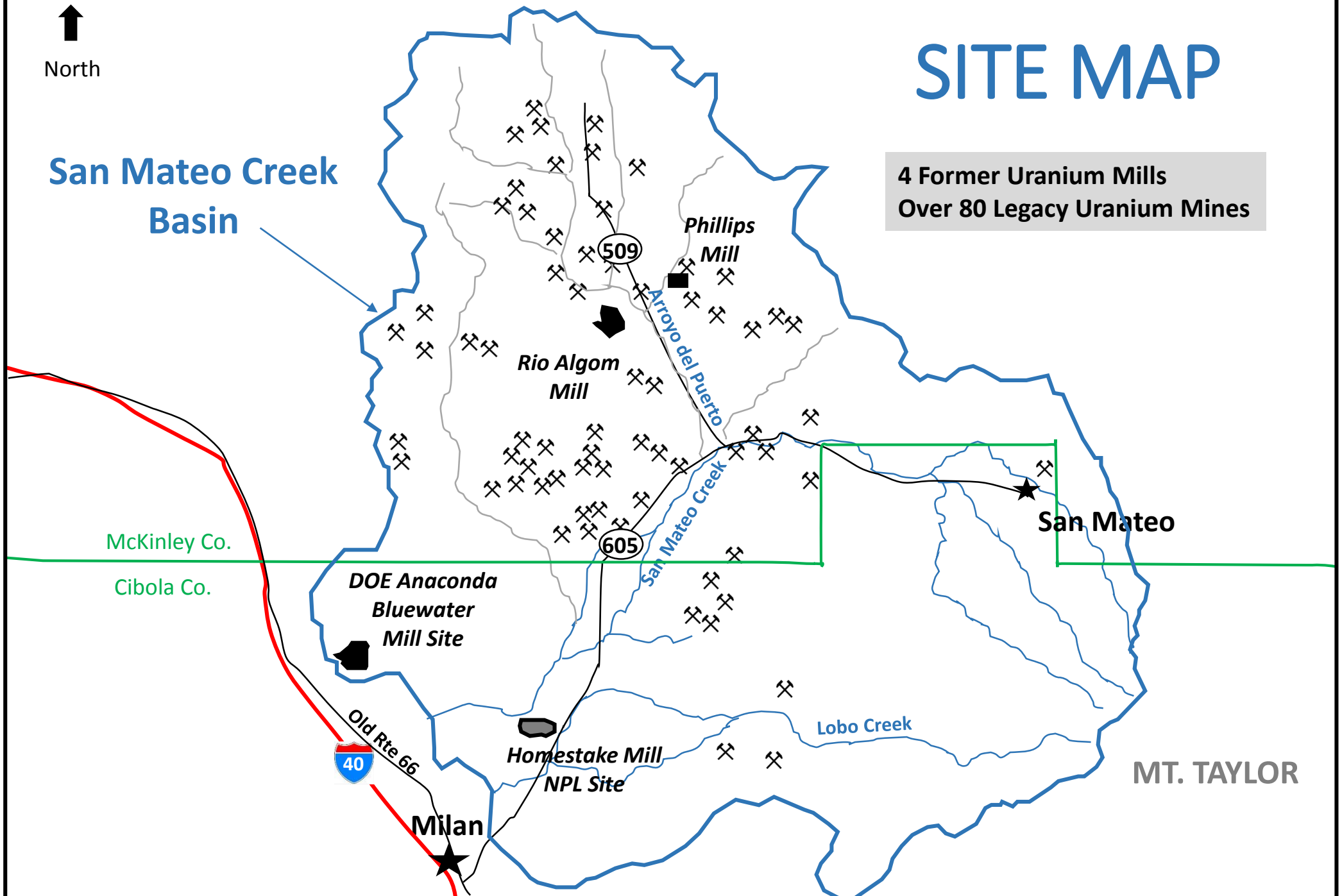
December 15, 2016

Presentation to Laguna Pueblo

9881503


Legacy of Uranium Mining in Northwestern New Mexico
Gallup
Study Area
Albuquerque
NEW MEXICO
Uranium Mine
Mill Location
City or Town
Uranium Sub-District
Pueblo of Acoma
Pueblo of Laguna
Navajo Nation Chapter
Navajo Nation Ownership
San Mateo Basin
NPL Site
County
Land Ownership for Tracts with Mines
Bureau of Land Management
Forest Service
Tribal Land
Private Land
State Land
Note:
The Land Ownership layer as displayed is not complete.
The only areas displayed are those containing one or more mines.
Sources:
MMD Legacy Uranium Mine Inventory. 12/2008.
EPA Region 6 National Priorities List (NPL), 5/2015.
Bureau of Land Management (BLM) Land Ownership.
Navajo Land Department 2016. Census Bureau 2000
TIGER/Line. ESRI World Shaded Relief.
0 5 10 15 20
Miles
N
W
E
S
EPA Region 6
Superfund
GIS Support
04/25/2016
20160425ML01
Northeast Church Rock Mine
UNC Mill
UNITED NUCLEAR CORP
AMBROSIA LAKE
MARQUEZ
LAGUNA
MCKINLEY COUNTY
SANDOVAL COUNTY
CIBOLA COUNTY
VALENCIA COUNTY
Navajo Nation
Pueblo of Laguna Reservation
Pueblo of Acoma Reservation
Rio Algom Mill
Phillips Mill
Johnny M. Mine
Bluewater Mill
Homestake Mill
HOMESTAKE MINING CO.
L-Bar Mill
Jackpile Mine
SAN MATEO CREEK BASIN
Grants
Gallup
Pinedale
Mariano Lake
Crownpoint
Whitehorse
Seven Lakes
Perea
McGaffey
Thoreau
Prewitt
Ambrosia Lake
San Mateo
Bluewater
Toltec
Milan
Grants
Sawyer
Copperton
El Dado
Eagle Nest
Marquez
Seboyeta
Bibo
Mesquino
Paguate
Encinal
Cubero
San Fidel
Anzac
McCartys
Paraje
New Laguna
Laguna
Acomita
Mesita
Marmon
57
509
371
40
53
SITE LOCATION MAP


San Mateo Creek Basin
Milan
Grants
Paguate
Encinal
Jackpile Mine
Seama
Laguna
Rio San Jose Basin
371
53
40
© 2016 Google

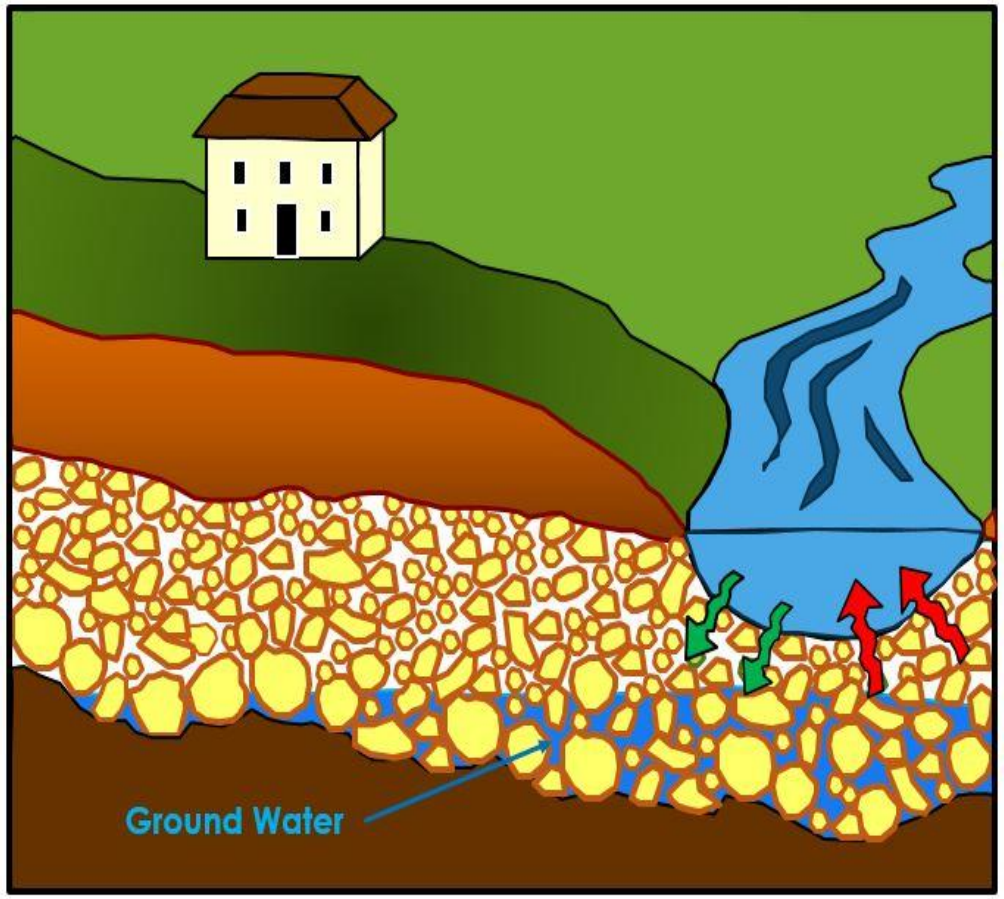

North
SITE MAP
San Mateo Creek Basin
4 Former Uranium Mills
Over 80 Legacy Uranium Mines
Phillips Mill
509
Arroyo del Puerto
Rio Algom Mill
San Mateo Creek
605
San Mateo
McKinley Co.
Cibola Co.
DOE Anaconda Bluewater Mill Site
Old Rte 66
40
Homestake Mill NPL Site
Lobo Creek
Milan
MT. TAYLOR

PROJECT OBJECTIVE

Characterize ground water quality and impact by legacy uranium mining and milling activities

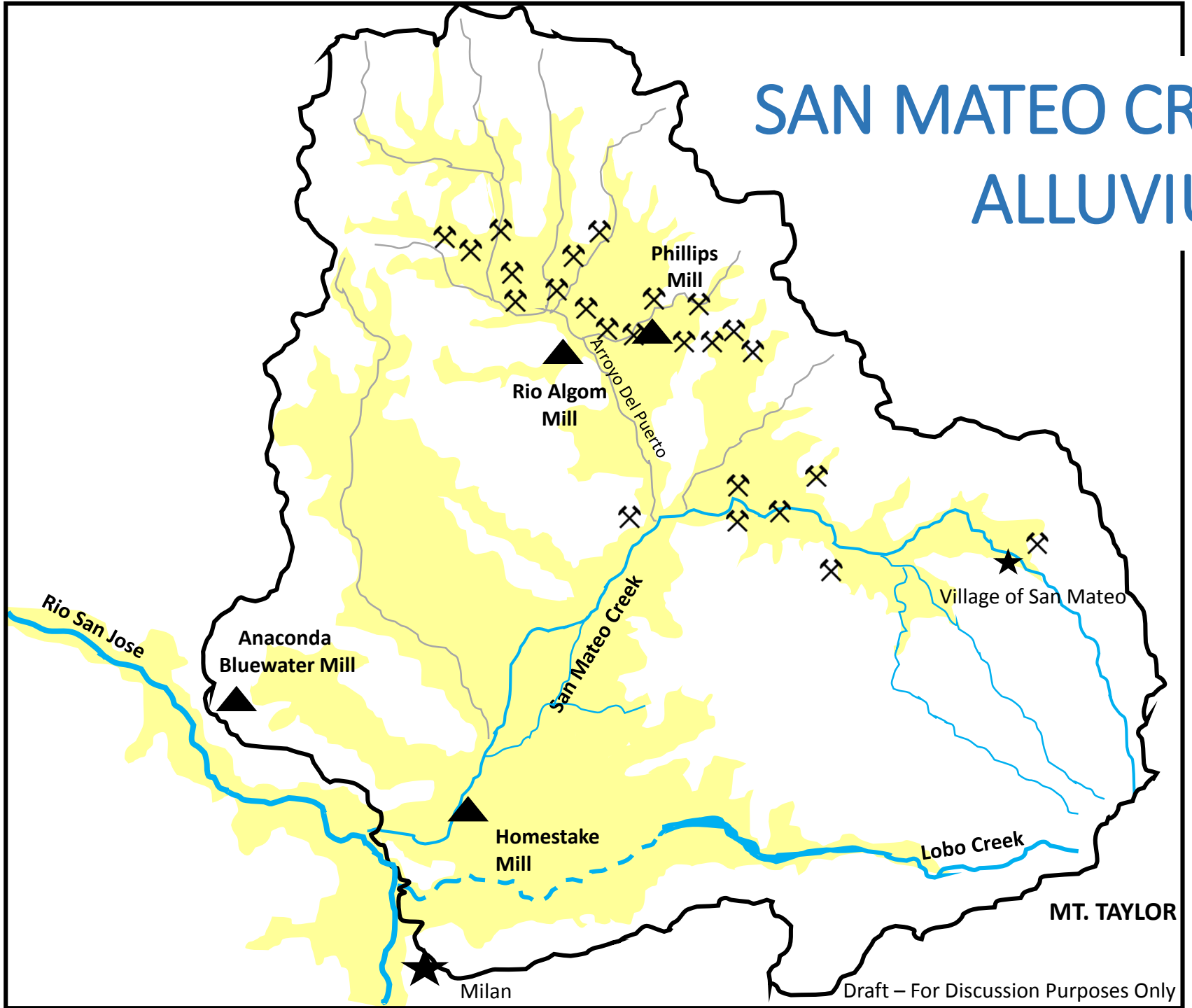
WHERE IS THE GROUND WATER?

- Alluvial Ground Water
  - Shallow ground water
  - At depths reaching about **120 feet** below ground surface
  - In sediments at base of drainage channels (arroyos, creeks)
- Bedrock Ground Water
  - Deeper ground water
  - Hundreds of feet below ground surface
  - In rock formations



Modified from City of Las Cruces
Poster Display

SAN MATEO CREEK BASIN ALLUVIUM



Alluvium

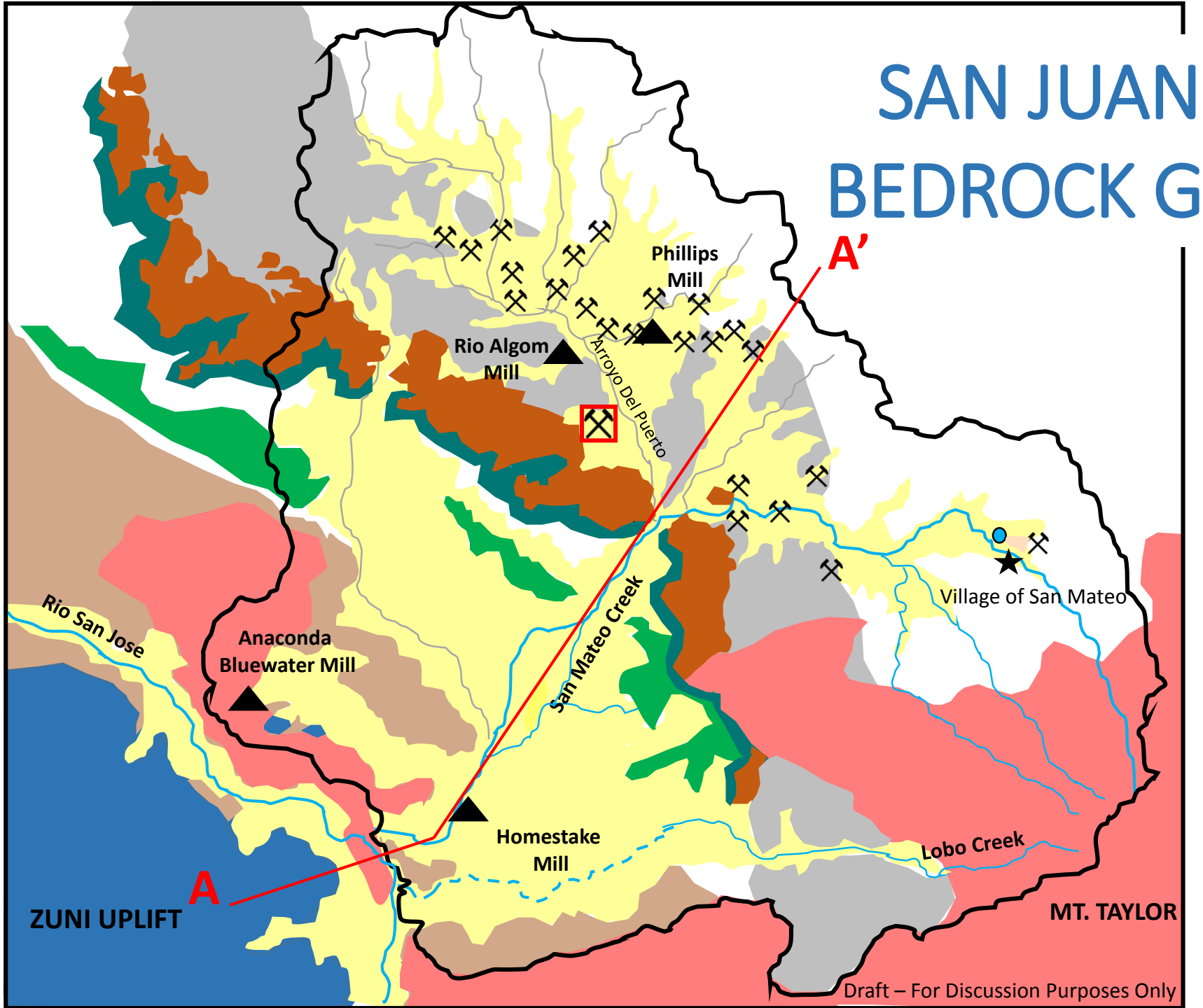
Wet Mine

ALLUVIUM:

Sediments Deposited in Basin from Erosional Processes;

Comprised of Sand, Silt, Clay and Gravel

SAN JUAN BASIN BEDROCK GEOLOGY

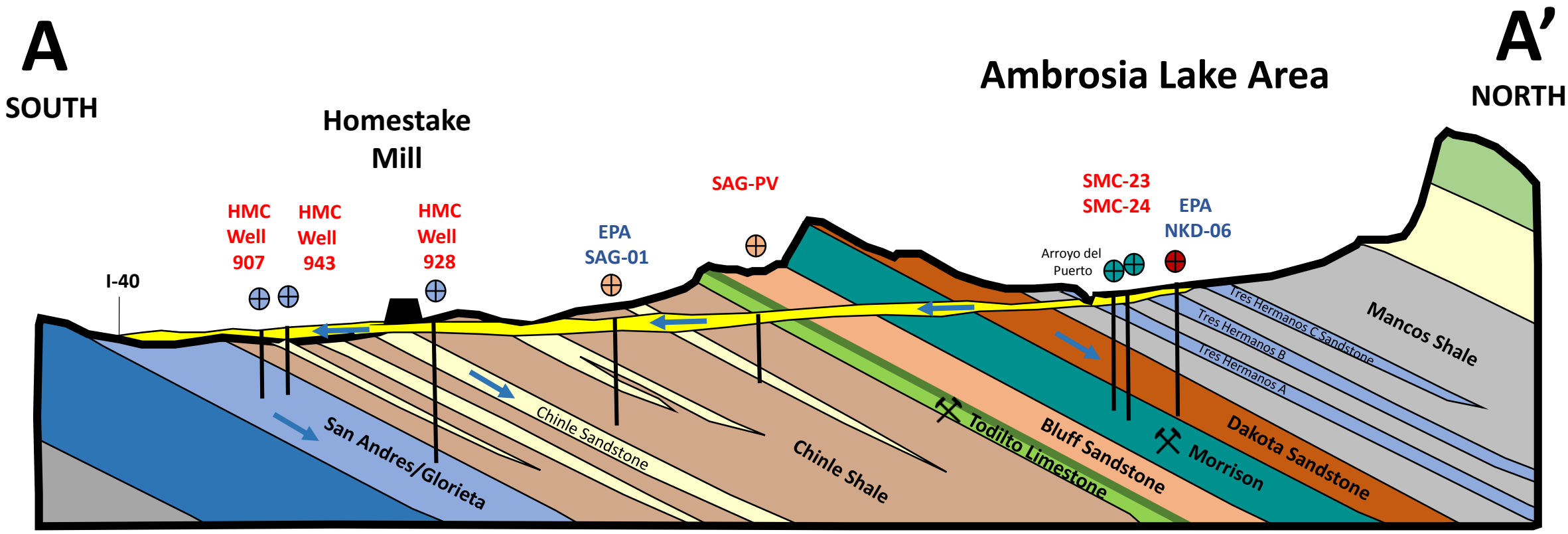


- Alluvium
- Mancos Shale
- Dakota Sandstone
- Morrison Fm
- Todilto Limestone
- Chinle Shale and Sandstone
- San Andres Limestone/ Glorietta Sandstone
- Volcanic
- Former Uranium Mill
- Wet Mine
- Spencer Mine

From USGS Geological Map

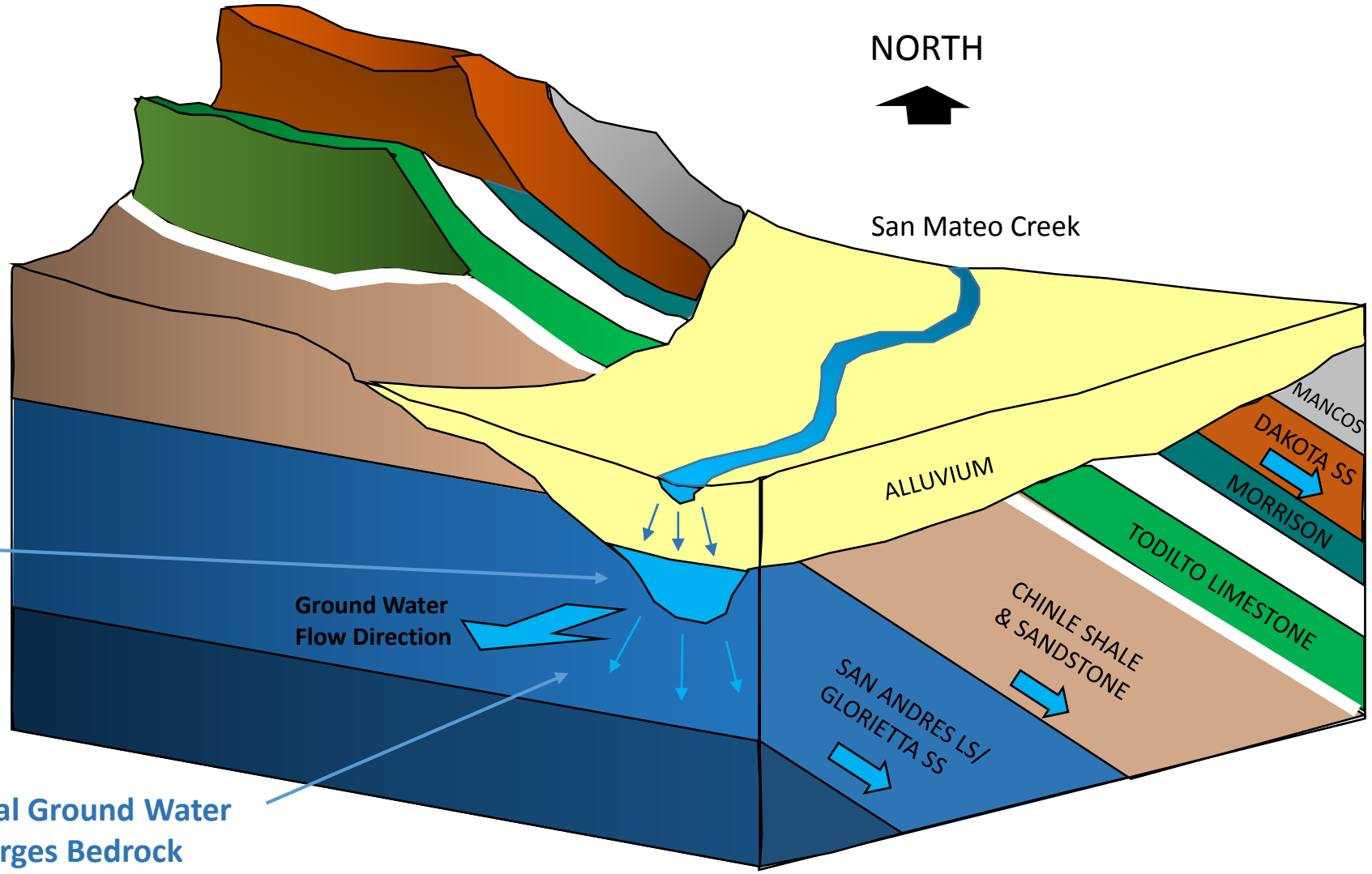
CONCEPTUAL SITE GROUND WATER MODEL

Generalized Cross Section Through San Mateo Creek Basin



Draft – For Discussion Purposes Only

CONCEPTUAL SITE GROUND WATER MODEL



Surface Water Recharges Alluvium

Alluvial Ground Water Recharges Bedrock Aquifers

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Not to Scale

EXPOSED BEDROCK FORMATIONS

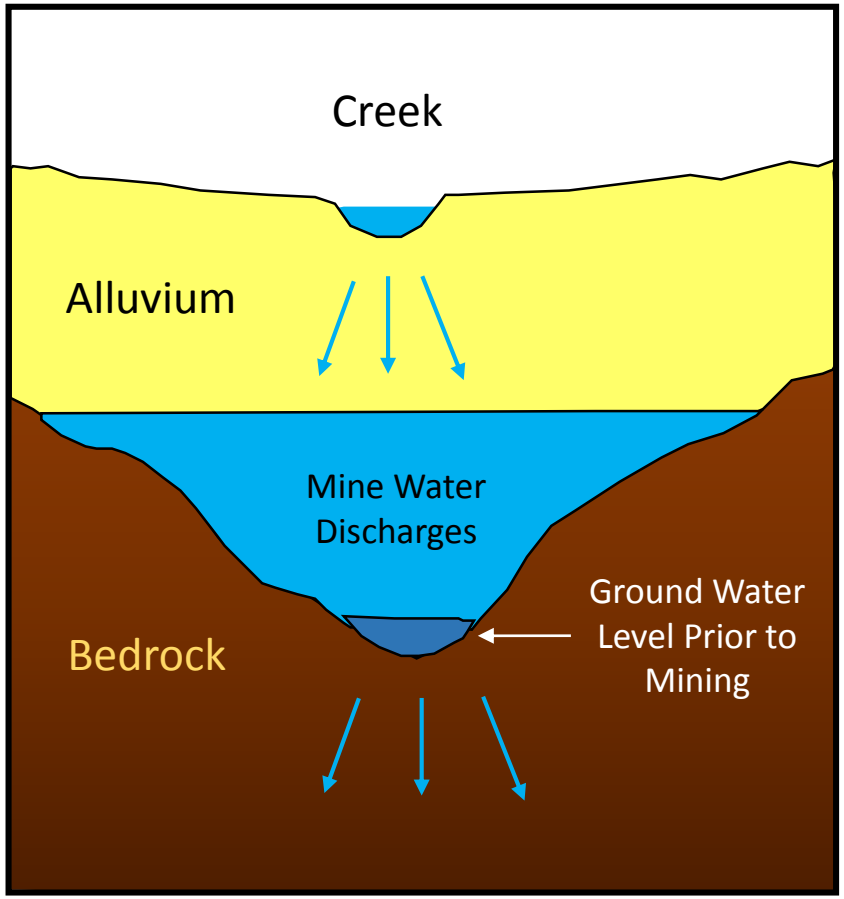
San Mateo Creek Basin

View Looking West from Hwy 605

View of Mt. Taylor Looking East from Hwy 605

HOW DID WET MINE OPERATIONS AFFECT GROUND WATER?

- ***Dewatered underground workings***
- ***Discharged billions of gallons*** of mine water to creeks and arroyos
- ***Water infiltrated*** into ground
- ***Increased amount of ground water*** in alluvial sediments and bedrock
- ***Changed quality*** of ground water



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Not to Scale

MINE WATER DISCHARGE

Artificially Created Surface Flows in Creeks and Arroyos

Wet Mine

EPA CONDUCTS MULTI-PHASED INVESTIGATION

Phase 1

Shallow Alluvial Aquifer
2012 – 2016
*(*Completed)

Phase 2

Bedrock & Alluvial Aquifers
2015 – 2017

Phase 3

Develop Conceptual Site Ground Water Model
2017 - 2018

Wet Alluvial Sediments

Bedrock Sandstone

Drill Bit and Piping

PHASE 1 ACTIVITIES COMPLETED

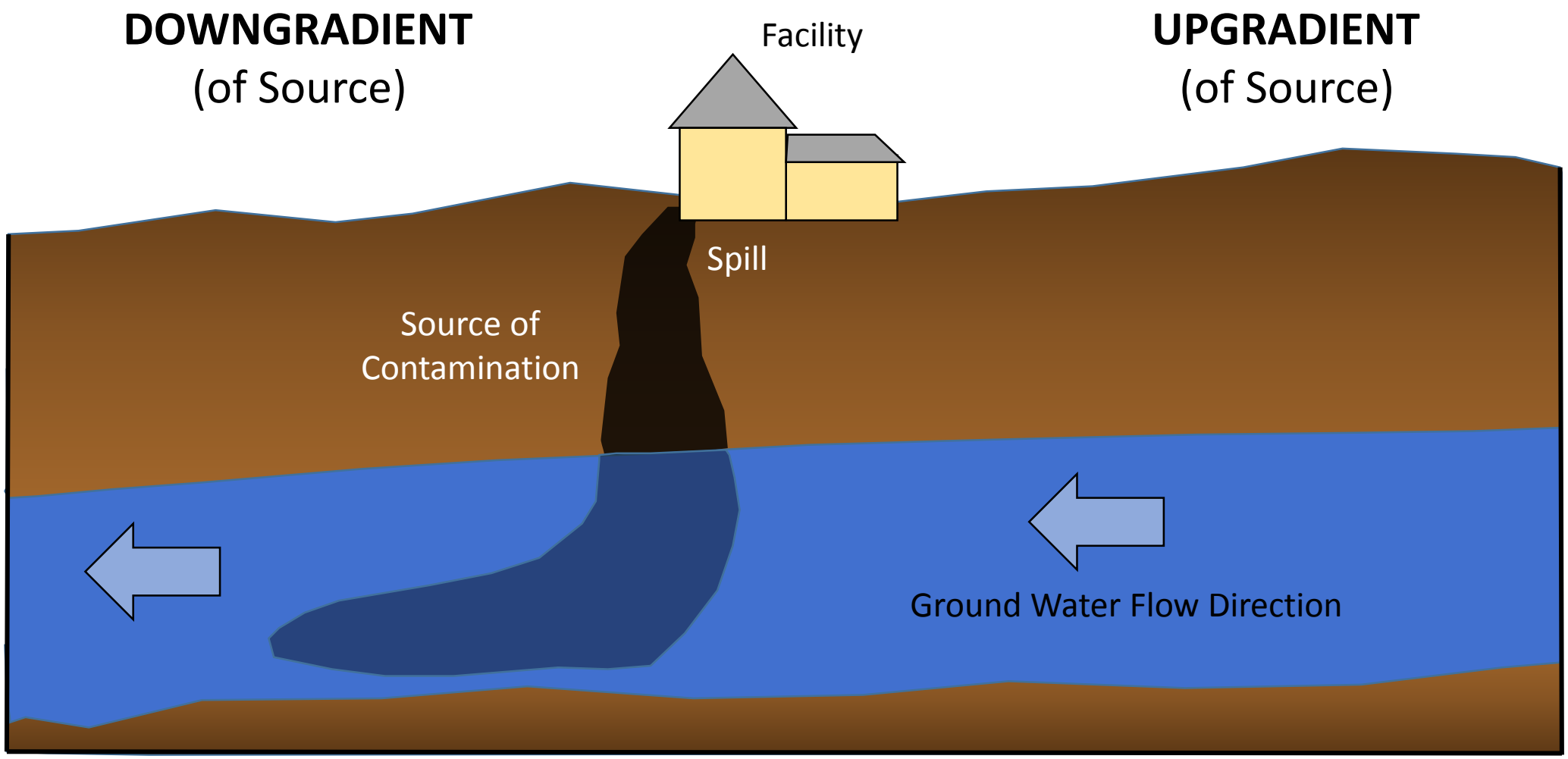
- 30 Boreholes Drilled
  - 6 monitoring wells installed where water encountered
  - 24 boreholes dry
- 15 Existing Wells Sampled
  - 10 private wells
  - 5 industry monitoring wells
  - Includes both alluvial and bedrock wells

Core Sample

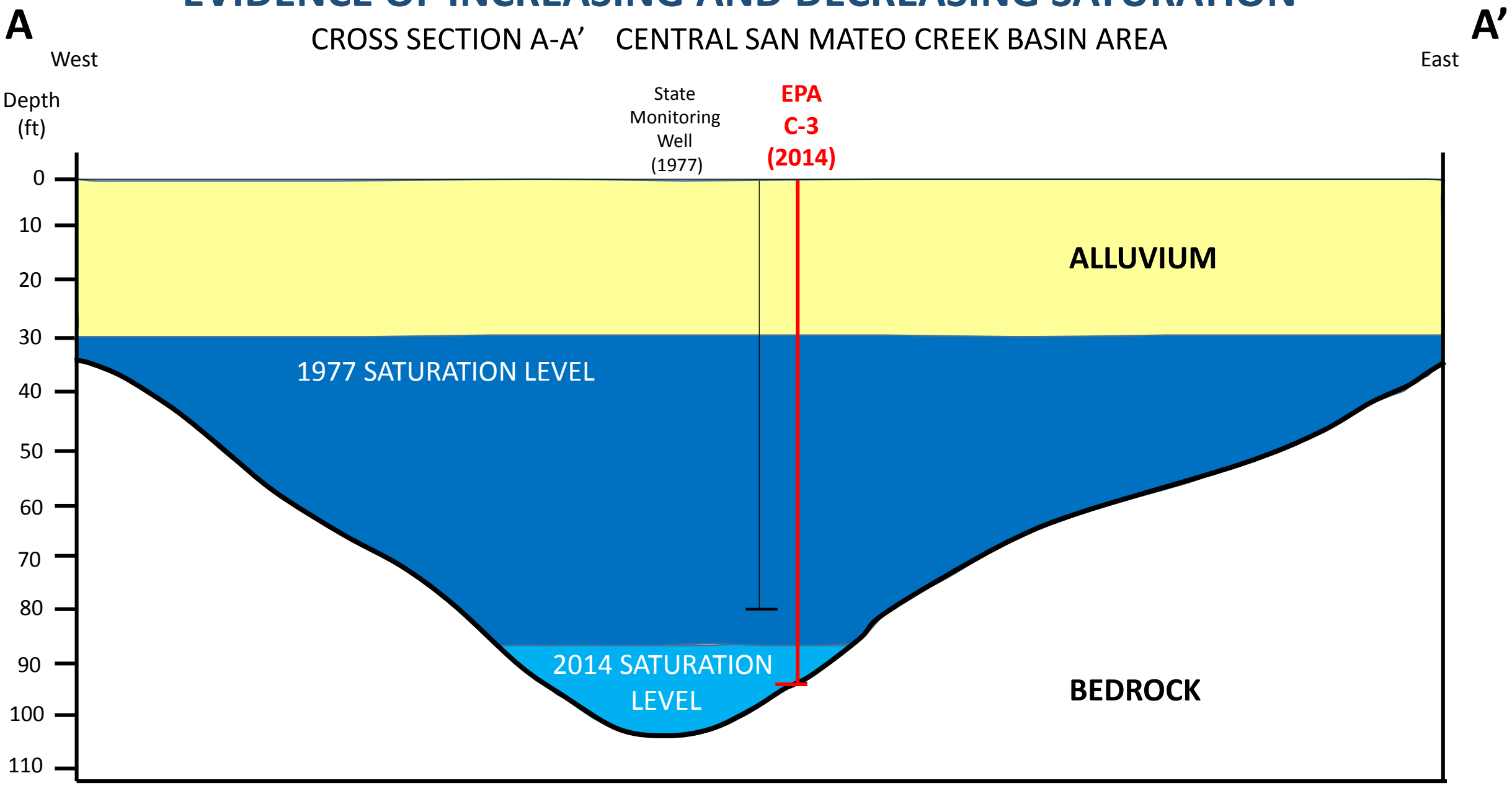
PHASE 1 RESULTS SUMMARY

- Attempt to Characterize Alluvial Water Quality had **Mixed Results**
  - Lack of Natural Saturation in Many Areas Investigated
- Alluvial **Water Quality Varies** Across Basin
  - Good quality upgradient of mines and mills
  - Poor quality downgradient of mines and mills
- Mine Discharge Water **Increased Saturation** in Alluvium
- Mine Discharge Water **Draining Out** of Alluvium Today

UPGRADIENT VS DOWNGRADIENT



EVIDENCE OF INCREASING AND DECREASING SATURATION



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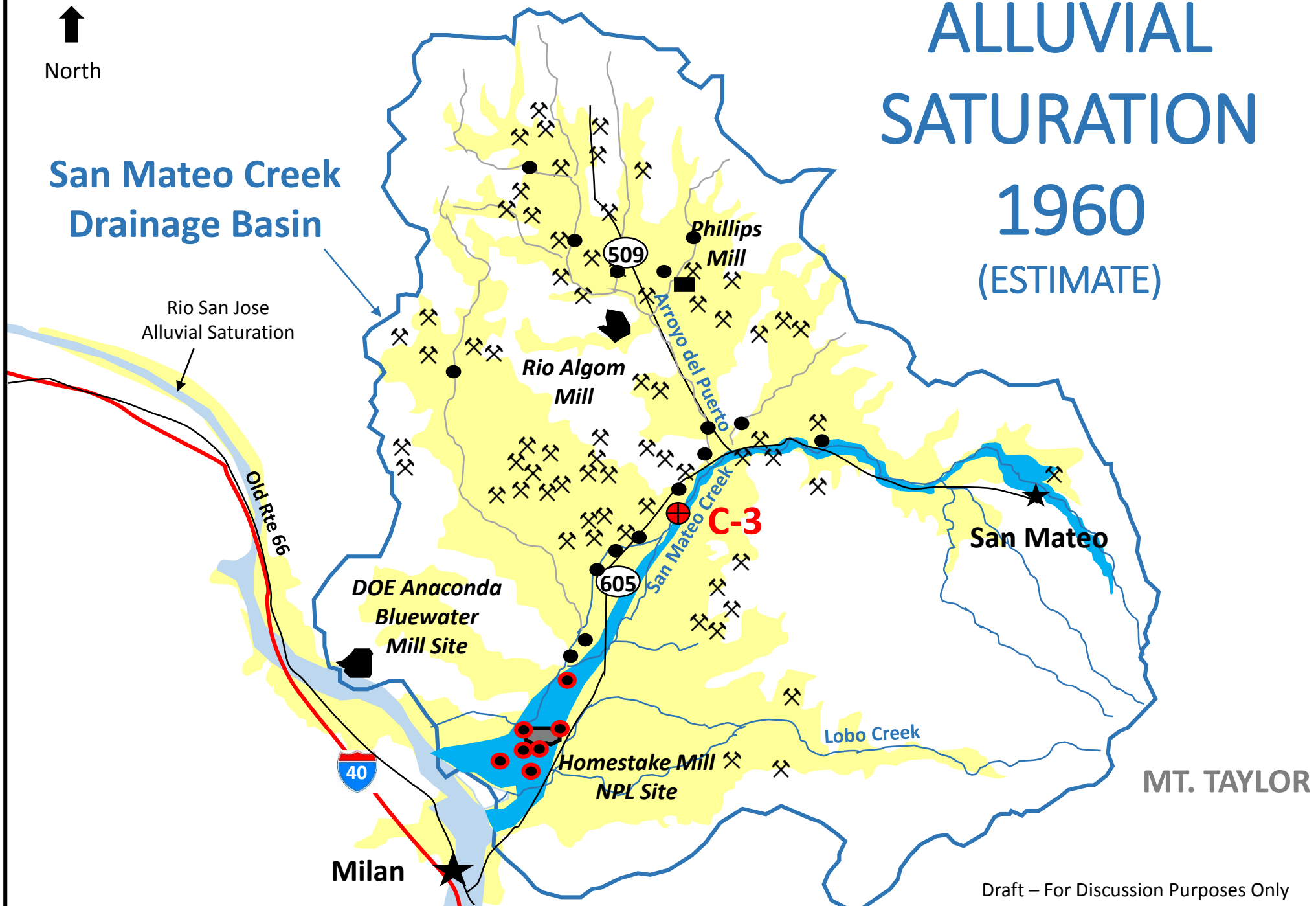

ALLUVIAL SATURATION 1960

(ESTIMATE)

Alluvium

SMC Alluvial Ground Water

Rio San Jose Alluvial Ground Water

EPA Monitoring Well - 2014

1960 or Older Well

Dry Borehole Drilled in 2014/2015

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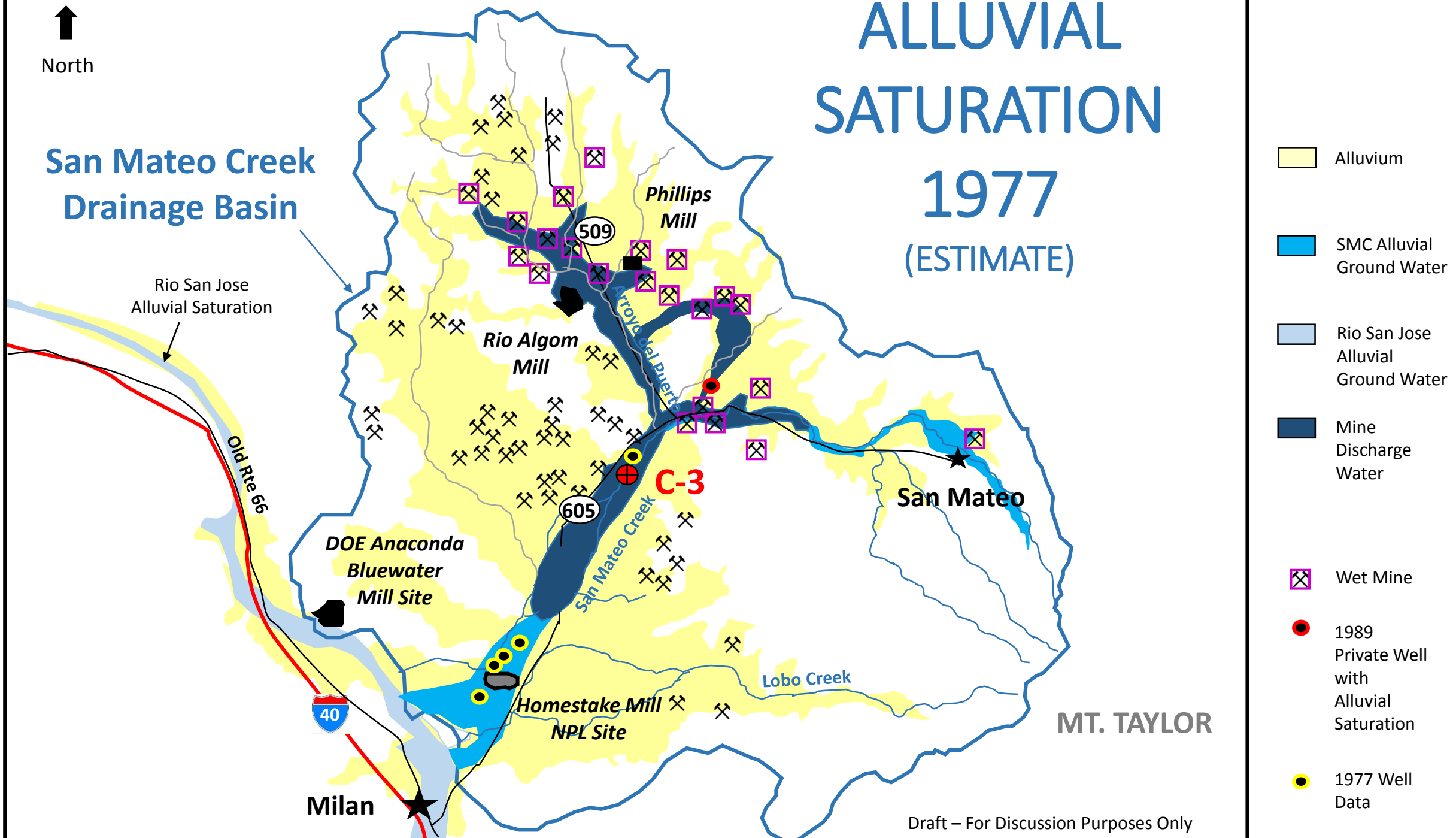
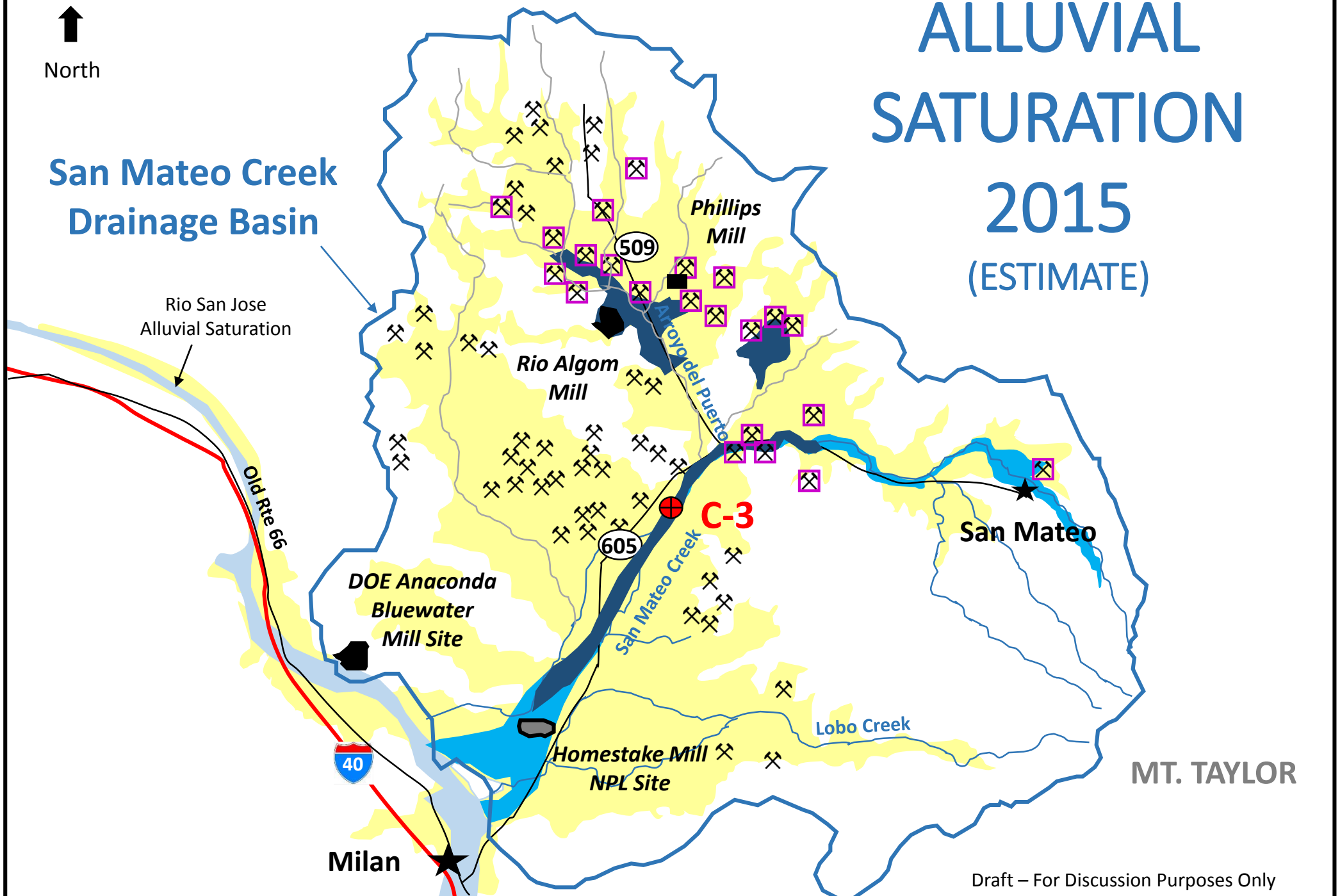

North
ALLUVIAL SATURATION 1977
(ESTIMATE)
San Mateo Creek Drainage Basin
Rio San Jose Alluvial Saturation
Old Rte 66
Phillips Mill
509
Rio Algom Mill
Arroyo del Puerto
C-3
605
San Mateo
San Mateo Creek
DOE Anaconda Bluewater Mill Site
Lobo Creek
Homestake Mill NPL Site
40
Milan
MT. TAYLOR
Alluvium
SMC Alluvial Ground Water
Rio San Jose Alluvial Ground Water
Mine Discharge Water
Wet Mine
1989 Private Well with Alluvial Saturation
1977 Well Data
Draft – For Discussion Purposes Only


North
ALLUVIAL SATURATION 2015
(ESTIMATE)
San Mateo Creek Drainage Basin
Rio San Jose Alluvial Saturation
Phillips Mill
509
Rio Algom Mill
Arroyo del Puerto
C-3
605
San Mateo
San Mateo Creek
DOE Anaconda Bluewater Mill Site
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Alluvium
SMC Alluvial Ground Water
Rio San Jose Alluvial Ground Water
Mine Discharge Water
Wet Mine
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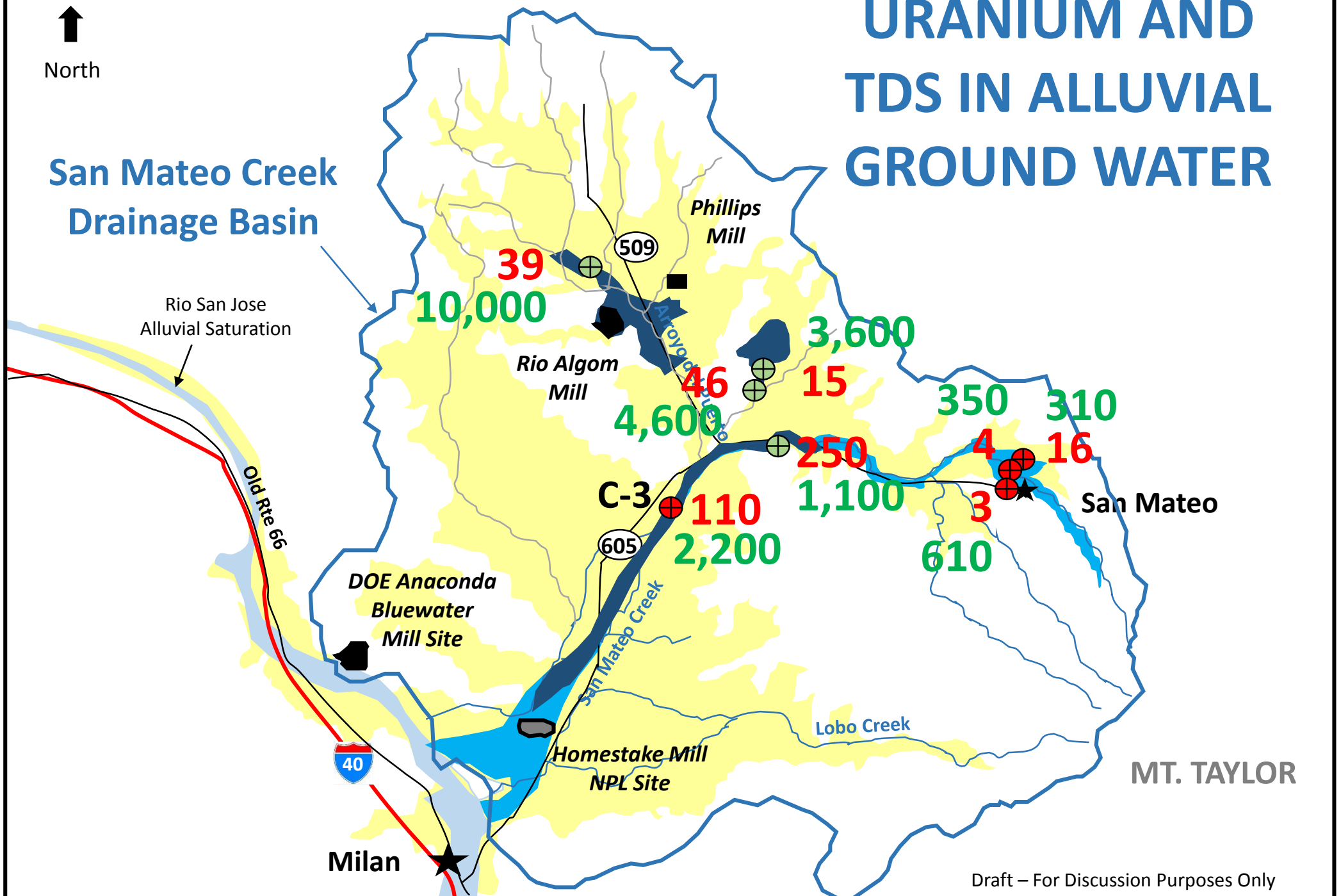
URANIUM AND TDS IN ALLUVIAL GROUND WATER
North
San Mateo Creek Drainage Basin
Rio San Jose Alluvial Saturation
Old Rte 66
Phillips Mill
509
39
10,000
Rio Algom Mill
Arroyo Atuelo
46
4,600
3,600
15
350
310
4
16
250
1,100
3
610
San Mateo
C-3
110
2,200
605
DOE Anaconda Bluewater Mill Site
San Mateo Creek
Lobo Creek
Homestake Mill NPL Site
40
Milan
MT. TAYLOR
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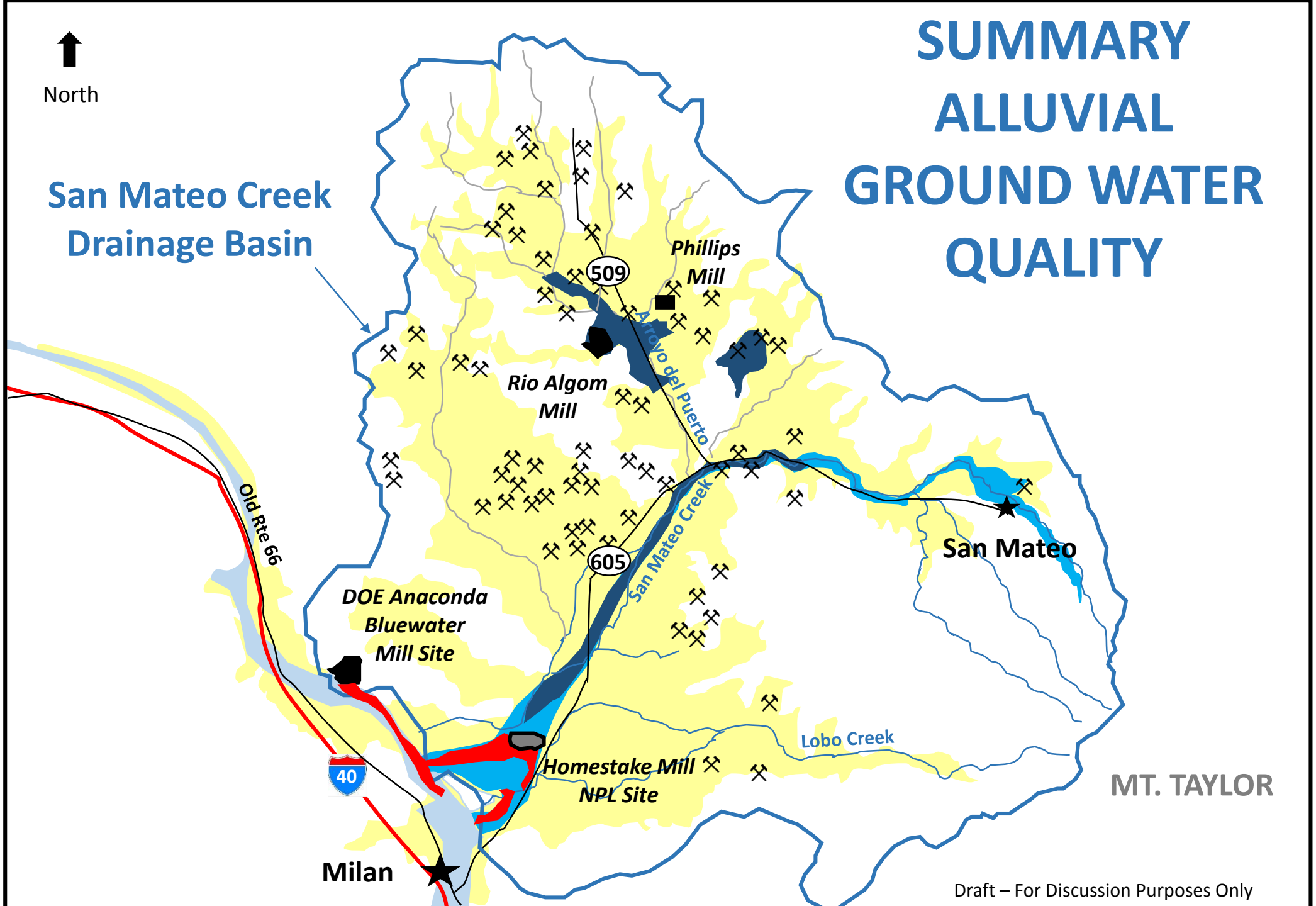
Alluvium
SMC Alluvial Ground Water
Rio San Jose Alluvial Ground Water
Mine Discharge Water
EPA Background Well
Well Downgradient to Legacy Mines
16 Uranium (ppb)
610 Total Dissolved Solids (ppm)


North
San Mateo Creek Drainage Basin
SUMMARY ALLUVIAL GROUND WATER QUALITY
Phillips Mill
509
Arroyo del Puerto
Rio Algom Mill
San Mateo Creek
605
San Mateo
Old Rte 66
DOE Anaconda Bluewater Mill Site
Lobo Creek
40
Homestake Mill NPL Site
MT. TAYLOR
Milan
Alluvium
SMC Alluvial Ground Water
Rio San Jose Alluvial Ground Water
Poor Alluvial Water Quality (Exceeds Standards)
Poor Alluvial Water Quality Contaminated by Homestake NPL site and Bluewater DOE site (Exceeds Standards)
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PLANNED ACTIVITIES FOR GROUND WATER INVESTIGATION